

# **ESA 077-2 Associated Milk Producers - Jim Falls, Wisconsin Public Report**

This report addresses a Steam System Assessment for the Associated Milk Producer's Facility in Jim Falls, Wisconsin.

This Assessment is co-funded by the Wisconsin **Focus on Energy** Program.

## **Objective of the ESA:**

The objective of the ESA was to identify cost-effective energy cost reduction measures by improving steam system efficiency. The primary steam generator is coal fired boiler.

This facility is one of five significant energy consumers operated by the firm in the region.

## **Focus of Assessment:**

The focus of the Assessment was on strategies to reduce fossil energy use through steam system efficiency improvements. Steam is used for process operations of heating and drying to produce cheese and byproducts.

## **Approach for ESA:**

The approach included the following:

1. Field Investigations/Analysis of Steam Systems and Sources
  - a. Survey of the Boiler Plant and distribution systems
  - b. Review of drawings documenting initial system design intent
  - c. Discussions with steam system operations and maintenance personnel
2. Identification and preliminary analysis of energy conservation opportunities

## **General Observations of Potential Opportunities:**

Energy consumption at the plant as indicated in the ESA application is as follows:

- Imported electricity: 12,500,000 kWh (43,000 mmBTUs)
- Coal: 43,000 mmBTUs
- Natural Gas: 28,400 mmBTUs.

## **System Description:**

The Steam Generation System was initially designed (circa 1955) to serve a 1500 kW steam turbine-generator that produced electricity for use on-site. There was also a second generator on site at the time. The Coal Boiler design conditions—365 PSIG (500 PSIG, max.) steam, superheated to 720°F (750°F, max.), 75,000 Pounds per Hour (PPH); were selected to maximize the power output of the turbine-generators. The initial design intent also provided for steam to be distributed for process uses at 160 PSIG, saturated. Currently, steam is throttled by a pressure reducing station and superheat is eliminated by a desuperheater. The Natural Gas Boiler, installed in the 1960s, can provide saturated steam at 365 PSIG (500 PSIG max. 90,000 PPH). There is no superheater in the natural gas unit.

“Condensate” is returned to the plant from a whey-drying process (condensate of whey) as well as from some end-use heat exchangers. All of the steam generated is from condensate returned to the plant from these sources. Condensate water temperature is 185°F. The condensate is pumped to the Deaerator (Chicago Heater) where it is heated with low pressure steam to 235° F. The Boiler Feedwater is pumped from the Deaerator through a “High Pressure” (160 PSIG) heater and an Economizer that heats the boiler feedwater to 254°F.

Due to differences in fuel prices, the coal boiler provides most of the steam demand of the production plant. The Natural Gas boiler is used only when the Coal Boiler undergoes annual or other maintenance.

- Current Coal Cost: \$4.90/mmBTUs
- Current Natural Gas Cost: \$7.00/mmBTUs

The operators are sensitive to the need to minimize smoke from the plant boilers.

Typical output for the boiler is 30,000 to 35,000 PPH. During morning periods, loads can decrease to 16,000 PPH, fluctuating by 10,000 to 20,000 PPH in short periods of time, causing problems maintaining stable combustion. The problems are due both to the low load (~20% of rated capacity), and the fluctuations. Low pressure steam is also generated in the plant at approximately 10 PSIG by two “Evaporators”. This steam is for boiler plant uses, and is distributed for processes uses. The Process Plant low pressure steam is supplemented by at least one steam pressure reduction station in the Old Boiler Room, which supplies steam from a high pressure main to the low pressure main.

Electricity is provided to the plant by the electric utility Xcel Energy. The current unit cost of electricity is around \$0.05/kWh.

## **Potential Energy Conservation Opportunities:**

### **Near Term**

- **Change Boiler Efficiency (SSAT Project 1.3); Improved Instrumentation and Monitoring:**

This recommendation involves the installation of flow meters to monitor output from the plant and major end use process loads. In addition, develop monthly reports indicating plant efficiency, and benchmarking steam use to production output measures. Anecdotal information indicates that savings of 2% to 5% can occur when such practices are implemented. The SSAT analysis assumed 2% efficiency improvement or savings; or \$38,000, based on coal at \$4.90/mmBTUs

- **Improve Steam Trap maintenance (SSAT Project 1.14):**

Both high pressure and low-pressure steam are distributed throughout the plant. Steam traps locations and characteristics are undocumented, but it was estimated that there are as many as 500 traps in the system. The SSAT model was used to determine the potential savings, based on the assumption of minimal maintenance during prior 3 to 5 years. The estimated savings are \$108,000/year.

- **Improve Insulation (SSAT Project 1.16):**

Using the 3EPlus model, and assuming 10% of High Pressure Steam Pipe (uninsulated segments, uninsulated valves) and 70% of condensate pipe (none is insulated now) is re-insulated, the estimated annual savings is \$35,000.

### **Mid- and Long Term**

- **Add Back-pressure turbine (SSAT Project 1.7)**

This measure involves the installation of a 700 kW back-pressure turbine-generator connected to the 365 PSI superheated steam output of the boiler plant. The turbine outlet condition will be 160 PSI, saturated—as is currently supplied to the processes. The SSAT analysis of this opportunity resulted in an estimated savings of \$221,000 per year. Implementation of this measure would be consistent with the initial design and operating intent for the steam plant as constructed in the late 1950s.

A potential secondary benefit associated with the turbine-generator installation is the opportunity to improve plant operations in the event of an electrical outage. The plant is currently served by two overhead utility sources. While the occurrence of extended electrical outages has been limited, the plant is shut-down when an outage occurs, as the availability of on-site electrical generation capacity is limited to a 500 kW diesel engine generator.

The turbine-generator steam load could also be used to mitigate the boiler operating problems reported during light load conditions, though the economic benefit during these operating periods would be marginal, if any.

**Management Support and Comments:**

Results and discussion of opportunities will be shared with key staff and management team responsible for 5 plants in the region.

Response to the Survey on the corporate practices has been provided.

**DOE Contact at Plant/Company:**

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